CLAIMS

What is claimed is:

1. A device comprising:

a micro-fluidic inlet channel to convey a process flow;

a plurality of micro-fluidic focusing channels to each convey one of a plurality of focusing flows, wherein the plurality of focusing channels include a first channel on a first side of the inlet channel, a second channel on a second side of the inlet channel, a third upper channel over the inlet channel, and a fourth lower channel under the inlet channel;

a focusing manifold coupled with the inlet channel at an inlet port, coupled with the first channel at a first focusing channel port on a first side of the inlet channel, coupled with the second channel at a second focusing channel port on a second side of the inlet channel, coupled with the third channel at a third upper focusing channel port over the inlet channel, and coupled with the fourth channel at a fourth lower focusing channel port under the inlet channel, the focusing manifold to focus the process flow by contacting four sides of the process flow with the plurality of focusing flows; and

a micro-fluidic outlet channel coupled with the focusing manifold at an outlet channel port to convey the focused process flow and focusing flows from the focusing manifold.

2. The device of claim 1:

wherein the first and the second focusing channels are angled relative to the inlet channel with sub-orthogonal angles;

wherein the third and the fourth focusing channels approach the focusing manifold from a same side thereof as the inlet channel;

wherein the third focusing channel is substantially vertically aligned over the inlet channel and the fourth focusing channel is substantially vertically aligned under the inlet channel;

wherein the focusing manifold comprises a shape of an upright cylinder;

wherein the focusing manifold comprises an upper spacing volume between an upper focusing channel port and the inlet port; and

wherein the void volume is in a range between 0.0005 mm^3 to 0.01 mm^3.

3. The device of claim 1:

wherein the third upper focusing channel is on the first side of the focusing channel, and the fourth lower focusing channel is on the second side of the focusing channel; and

wherein the third upper focusing channel and the fourth lower focusing channel approach the focusing manifold from opposite sides thereof and are angled relative to the inlet channel with substantially equal angles.

4. The device of claim 3:

wherein the plurality of focusing channels comprise an additional upper focusing channel over the inlet channel on the second side of the focusing channel, and an additional lower focusing channel under the inlet channel on the first side of the focusing channel; and

wherein the additional upper focusing channel and the third upper focusing channel approach the focusing manifold from opposite sides thereof and are angled relative to the inlet channel with substantially equal angles.

5. A device comprising:

a micro-fluidic inlet channel to convey a process flow;

a plurality of micro-fluidic focusing channels to each convey one of a plurality of focusing flows;

a focusing manifold coupled with the inlet channel at an inlet port and with the plurality of focusing channels at a plurality of focusing channel ports to focus the process flow by contacting at least three sides of the process flow with the plurality of focusing flows; and

a micro-fluidic outlet channel coupled with the focusing manifold at an outlet channel port to convey the combined focused process flow and focusing flow from the focusing manifold.

6. The device of claim 5, wherein the plurality of micro-fluidic focusing channels comprise four micro-fluidic focusing channels.

7. The device of claim 6:

wherein the four micro-fluidic focusing channels comprise a first micro-fluidic focusing channel on a first side of the inlet channel, a second micro-fluidic focusing channel on a second side of the inlet channel, a third upper micro-fluidic focusing channel over the inlet channel, and a fourth lower micro-fluidic focusing channel under the inlet channel; and

wherein the plurality of focusing channel ports comprise a first focusing channel port on a first side of the inlet channel, a second focusing channel port on a second side of the inlet channel, a third upper focusing channel port over the inlet channel, and a fourth lower focusing channel port under the inlet channel

8. The device of claim 7, wherein the third and the fourth focusing channels approach the focusing manifold from a same side thereof as the inlet channel.

9. The device of claim 8, wherein the third focusing channel is substantially vertically aligned over the inlet channel and the fourth focusing channel is substantially vertically aligned under the inlet channel.

10. The device of claim 5, wherein the focusing manifold comprises a shape of an upright cylinder, and wherein the void volume is in a range between 0.005mm3 to 0.01mm3.

11. The device of claim 5, wherein the focusing manifold comprises an upper spacing volume between an upper focusing channel port and the inlet port.

12. The device of claim 5, wherein the plurality of focusing channels comprise six channels, the six channels including a first focusing channel on a first side of the inlet channel, a second focusing channel on a second side of the inlet channel, a third upper focusing channel over the inlet channel on the first side of the focusing channel, a fourth upper focusing channel over the inlet channel on the second side of the focusing channel, a fifth lower focusing channel under the inlet channel on the first side of the focusing channel, and a sixth lower focusing channel under the inlet channel on the second side of the focusing channel.

13. The device of claim 12, wherein the third upper focusing channel and the fourth upper focusing channel are on opposite sides of the focusing manifold and are angled at substantially equal angles relative to the inlet channel.

14. The device of claim 13, wherein the substantially equal angles comprise orthogonal angles.

15. The device of claim 14, wherein the third upper focusing channel is substantially vertically aligned over the fifth lower focusing channel and a third upper focusing channel port is substantially vertically aligned over a fifth lower port.

16. The device of claim 5, wherein the plurality of focusing channels include a first focusing channel on a first side of the inlet channel, a second focusing channel on a second side of the inlet channel, a third upper focusing channel over the inlet channel on the first side of the focusing channel, and a fourth lower focusing channel under the inlet channel on the second side of the focusing channel.

17. The device of claim 16, wherein the third upper focusing channel and the fourth lower focusing channel are on opposite sides of the focusing manifold and are angled at substantially equal angles relative to the inlet channel.

18. The device of claim 17, wherein the substantially equal angles comprise orthogonal angles.

19. A device comprising:

a micro-fluidic inlet channel to convey a process flow;

at least three micro-fluidic focusing channels to each convey one of a plurality of focusing flows;

a focusing manifold coupled with the inlet channel at an inlet port, coupled with the at least three micro-fluidic focusing channels at a plurality of focusing channel ports; and

a micro-fluidic outlet channel coupled with the focusing manifold at an outlet channel port to convey the focused process flow and focusing flows from the focusing manifold..

20. The device of claim 19, wherein the at least three micro-fluidic focusing channels include a first channel coplanar with the micro-fluidic inlet channel and a second focusing channel not coplanar with the micro-fluidic inlet channel.

21. The device of claim 19, wherein the at least three micro-fluidic focusing channels include a channel over the micro-fluidic inlet channel.

22. The device of claim 19, wherein the at least three micro-fluidic focusing channels include a channel under the micro-fluidic inlet channel.

23. A method comprising:

introducing a process flow into a focusing manifold through a micro-fluidic inlet channel;

introducing a plurality of focusing flows into the focusing manifold through a plurality of micro-fluidic focusing channels;

focusing the process flow by contacting at least three sides thereof with the plurality of focusing flows in the focusing manifold; and

removing the focused process flow from the focusing manifold through a micro-fluidic outlet channel.

24. The method of claim 23, wherein said focusing comprises focusing the process flow inward from all sides thereof with the plurality of focusing flows.

25. The method of claim 23, wherein said focusing comprises separating a top side of the process flow from an upper wall of the outlet channel with the plurality of focusing flows.

26. The method of claim 23, wherein said focusing comprises focusing the process flow to a vertical dimension that is less than a vertical dimension of the outlet channel with the plurality of focusing flows.

27. The method of claim 23, wherein said focusing comprises focusing the process flow to a vertical cross sectional dimension that is not greater than a cross sectional dimension of an interrogation signal associated with an analysis of the focused process flow.

28. The method of claim 23, wherein said focusing comprises tilting the process flow within the outlet channel with the plurality of focusing flows.

29. The method of claim 23:

wherein said introducing the plurality of focusing flows into the focusing manifold comprises introducing at least one focusing flow with a different pressure; and

wherein said focusing comprises positioning the process flow in the outlet channel based on the different pressure.

30. The method of claim 23:

wherein said focusing comprises focusing the process flow so that all dimensions are not greater than a cross sectional dimension of an interrogation signal; and

further comprising analyzing the focused process flow with the interrogation signal.

31. The method of claim 23:

wherein said introducing the process flow comprises introducing a process flow comprising a biological molecule; and

further comprising analyzing the single biological molecule in the focused process flow.

32. The method of claim 31, wherein the biological molecule comprises a fluorescently labeled biological molecule.

33. The method of claim 31, wherein the biological molecule comprises a protein.

34. The method of claim 23:

wherein said introducing the process flow comprises introducing a process flow comprising a charged species; and

further comprising analyzing the charged species in the focused process flow with a transistor.

35. An analysis system comprising:

a micro-fluidic device;

a hydrodynamic focusing system of the micro-fluidic device, the hydrodynamic focusing system containing:

a micro-fluidic inlet channel to convey a process flow;

a plurality of micro-fluidic focusing channels to each convey one of a plurality of focusing flows;

a focusing manifold coupled with the inlet channel at an inlet port and with the plurality of focusing channels at a plurality of focusing channel ports to focus the process flow by contacting at least three sides of the process flow with the plurality of focusing flows; and

a micro-fluidic outlet channel coupled with the focusing manifold at an outlet channel port to convey the combined focused process flow and focusing flow from the focusing manifold;

an analysis device to analyze a portion of the focused process flow conveyed in an interrogation region of the micro-fluidic outlet channel.

36. The analysis system of claim 35, wherein the plurality of micro-fluidic focusing channels comprise:

a first micro-fluidic focusing channel on a first side of the inlet channel;

a second micro-fluidic focusing channel on a second side of the inlet channel;

a third upper micro-fluidic focusing channel over the inlet channel; and

a fourth lower micro-fluidic focusing channel under the inlet channel.

37. The analysis system of claim 35, wherein the analysis device comprises a Raman spectrometer.

38. The analysis system of claim 35, further comprising a source of a biological molecule coupled with the micro-fluidic inlet channel.

39. The analysis system of claim 38, wherein the source of the biological molecule comprises a source of a fluorescently labeled biological molecule.

40. The analysis system of claim 35, wherein the source of the biological molecule comprises a source of a nucleic acid derivative.

41. The analysis system of claim 35, wherein the source of the biological molecule comprises a source of a protein.